THE CLASSIFICATION OF PLANTS. III.

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In a natural system of classification, plants are grouped according to their supposed relationships. Some groups have resemblances which leave little doubt as to the affinities of its members. Each subkingdom has a number of such groups. These greatest groups in the subkingdom are called *classes*. A class may then be defined as a group of plants in a subkingdom, the members of which show an evident relationship to one another because of similarity of morphological and physiological characters. This relationship must apparently be closer among the members of the group than to any other member in the subkingdom. The relationship of the class to other classes in the subkingdom is in many cases indeterminable at present, or at least so obscure that it gives rise to numerous disagreements among systematists. This obscurity indicates that most of the classes were segregated in primitive times, probalby before they had passed from the condition of the next lower subkingdom or stage of development. Thus classes and subclasses represent more or less parallel lines of development in the same stage of evolution. The class is not to be extended beyond one subkingdom, even though its missing links be found or generally assumed. Mere similarity of superficial morphological characters is, however, not sufficient to establish relationship; for as is well known, the same evolutionary tendencies may be operative in entirely distinct groups and bring about quite similar morphological results. The mere acquisition of some peculiarity or the loss of another can not be regarded as of any special importance in establishing a class. For example, it might turn out in the future that some Conifers or Angiosperms possess motile spermatozoids. But this peculiarity might persist in any of the higher groups and in itself could be of no importance in classification. All possible morphological characters must be taken into consideration in establishing a class, due weight being given to the possibilities and impossibiliites of derivation, for each structure involved, from its supposed ancestral type. Quite commonly relationships are claimed between groups where the derivation of the one from the other involves an improbable or impossible modification of the parts, and a profound credulity is required before assent to the proposition is possible. Unfortunately we are still far from possessing the necessary general knowledge of plant structures and developments to make a definite disposition of the larger groups. It is evident that there must continue to be considerable diversity of opinion as to the number and limits of plant classes. Yet properly compre-

hended, the class stands out as the large unit of classification and with a fair knowledge of structure and function there should be little necessity for the shifting of species from one class to another.

In some cases it is a comparatively easy matter to recognize the class while in others it is exceedingly difficult. In the Homosporous Pteridophytes there are plainly three distinct types of living species, lycopods, horsetails, and ferns, and these represent the three classes of the subkingdom. Whether the ferns could be regarded as reprensenting more than one phylogenetic branch may be a question with some. The quillworts show characters which exclude them from both the selaginellas and the eusporangiate ferns. For this reason they have been shifted about from one place to another without finding a permanent home.

Evidently in all such cases the proper procedure is to establish a distinct class and then the arguments as to their relationship with other classes may proceed pro and con ad infinitum.

In a general way one may recognize relationships between certain classes and if this is possible such a group of classes will constitute a *phylum*. A phylum then represents one of the great fundamental branches of the plant kingdom and consists of a number of classes supposed to be more closely related to one another than to other classes. The Angiosperms are no doubt such a phylum. They are not only the greatest group of plants but a very isolated group which appears to have come from a common ancient stock. The Gymnosperms are probably a polyphyletic subkingdom. The Cyanophyceae, Schizomycetes, and Myxoschizomycetes probably represent a phylum, the Schizophyta. A phylum may extend from one subkingdom to another. This is probably the case with lycopods, selaginellas and their fossil allies. But as a general rule the relationships between lower and higher groups have not been definitely determined. Too little is known of the morphology and geological history of plants to make possible the establishment of phyla with any great certainty.

Henry Shaler Williams, in his Geological Biology, makes the following important statements on this point:

"The arrangement into branches, therefore, is from a structural point of view highly artificial; and for purposes of tracing the history, or even from a taxonomic point of view, it is of little importance to deal with characters more ancient or of higher rank than the class characters."

"It may be convenient to associate the classes together into larger groups; but to reach the point of real union of their characters, in order to associate two or more classes in a common

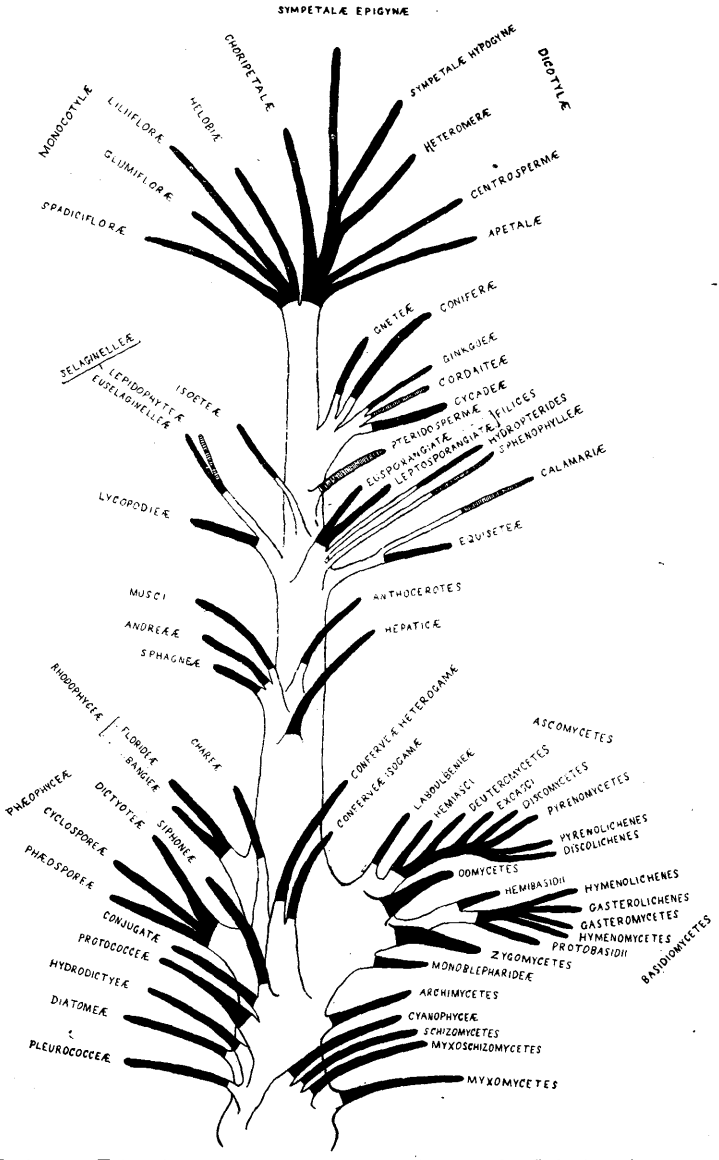

Diagram showing the approximate relationships of the classes and subclasses of plants.

group, leads us far back into the uncertain mists of earliest geological time, and into the similar mists of embryonic homogeneity. It is impracticable in the present stage of science to trace the evolutionary history of classes."

In some cases a class may fall into two or more well defined subordinate groups which are quite distinct and still show an evident relationship. These are called subclasses. The general subgroups of a class or subclass are the orders; the orders divide up into suborders and families; the families into subfamilies and genera; and the genera into species. The species may also be made up of subgroups which are at present still imperfectly understood and defined.

Phyla, classes, orders, and families and other subordinate groups then represent branches of closer and closer relationships, shown by similarities of essential structures and produced by segregation as the result of diversity of evolution and destruction of intermediate types; while series and subkingdoms stand for horizons or progressive stages of the evolution of the plant kingdom.

The main groups of plants rank as follows:

Groups representing stages of progressive evolution.	SERIES SUBKINGDOM.
Groups representing phylogenetic relationships..	PHYLUM CLASS (SUBCLASS) ORDER (SUBORDER) FAMILY (SUBFAMILY) GENUS SPECIES.

The orders are always to end in *ales* and the families in *aceae*. Definite endings should also be adopted for the classes, suborders, and subfamilies.

In the accompanying diagram all classes and subclasses recognized by the writer are given with their approximate relationship indicated by the branchings of the "tree." It was thought best not to attempt to indicate any definite relationships between the higher Algae and Fungi although some authors have in the past presented such schemes some of which may have more or less merit. In a future paper the classes given will be briefly defined in their proper order.